CLAIMS

1. A method of pumping wellbore liquid, comprising the steps of:

a) installing an electric submersible pump in a wellbore; and

b) operating the pump at more than 4,500 rpm to pump the wellbore liquid.

2. A method according to claim 1, wherein the pump comprises a permanent magnet motor.

3. A method according to claim 2, wherein the motor is an AC synchronous permanent magnet motor.

4. A method according to claim 1, 2 or 3, wherein the pump is a centrifugal pump.

5. A method according to any preceding claim, further comprising the step of recovering the wellbore fluid to the surface.

6. A method according to any preceding claim, further comprising the step of transporting the wellbore liquid from a first subterranean location to a second subterranean location.

7. A method according to any preceding claim, wherein the pump is operated at more than 5,000 rpm, and preferably more than 6,000 rpm.

8. A method according to any preceding claim, wherein the pump is operated at 7,000 to 7,500 rpm, and preferably at approximately 7,200 rpm.

9. A method according to any preceding claim, for pumping wellbore liquid in a multi-lateral drilling environment, wherein the pump is operative to draw the wellbore liquid from a plurality of lateral well bores into a central sump.

10. An electric submersible pump comprising a permanent magnet motor having a rotor comprising a plurality of permanent magnets (204) equiangularly spaced about a central shaft (201), a plurality of tubular elements supporting the permanent magnets (204) spaced at different axial locations along the shaft (201), a retaining sleeve (205) tightly fitted over the permanent magnets (204) so as to retain the permanent magnets (204) on the shaft (201), and a stator coaxial with the rotor comprising a stack of laminations (206) and radially spaced coils wound around the stack.

11. A pump according to claim 10, wherein the motor is an AC synchronous permanent magnet motor.

12. A pump according to claim 10 or 11, wherein the motor is capable of reliably operating at speeds greater than 4,500rpm.

13. A pump according to claim 10, 11 or 12, wherein the shaft (201) of the motor is supported by bearings located between the tubular elements along the shaft (201).

14. A pump according to claim 13, wherein the shaft (201) of the motor incorporates lubricating passages for supplying lubricating fluid to the bearings.

15. A pump according to claim 13 or 14, wherein the bearings incorporate spiral grooves for promoting the flow of lubricating fluid through the grooves to increase the bearing pressure.

16. A motor having a rotor comprising a carrier sleeve (203) mounted on a central shaft (201), and a stator coaxial with the rotor comprising a stack of laminations (206) and radially spaced coils wound around the stack, wherein the carrier sleeve (203) is a loose fit on the shaft (201) and is supported on the shaft (201) by support rings (411) closely engaging the shaft (201).

18. A motor according to claim 17, wherein the carrier sleeve (203) is keyed to the shaft (201) to prevent relative rotation between the carrier sleeve (203) and the shaft (201).

19. A motor according to claim 18, wherein a key (413) extending outwardly from the shaft (201) engages complementary locating portions of the carrier sleeve (203) and associated support ring (411) to prevent relative rotation between the carrier sleeve (203), the support ring (411) and the shaft (201).

20. A motor according to claim 19, wherein the key (413) is of relatively short length by comparison with the length of the carrier sleeve (203).

21. A motor according to any one of claims 17 to 20, wherein a plurality of carrier sleeves (203) are provided at axially spaced locations along the shaft (201), the carrier sleeves (203) being rotationally locked to the shaft (201).

22. A motor according to claim 21, wherein the carrier sleeves (203) are supported on the shaft (201) by support rings (411) closely engaging the shaft (201) and alternating on the shaft (201) with the carrier sleeves (203), the assembly of carrier sleeves (203) and support rings (411) being constrained on the shaft (201) by retaining means (414).

23. A motor according to any one of claims 17 to 22, wherein the shaft (201) is supported by bearings within a tubular housing (202).

24. A motor according to claim 23, wherein the bearings act between the support rings (411) and an inside bore wall of the stator.

25. A motor according to any one of claims 17 to 24, wherein a plurality of permanent magnets (204) mounted on the carrier sleeve (203) are equiangularly spaced about the shaft (201).

26. A permanent magnet motor having a rotor comprising a carrier sleeve (203) mounted on a central shaft (201) and bearing a plurality of permanent magnets (204) having axial ends, and a retention sleeve (205) extending over the magnets (204) and having at least one end turned in over at least one stress-relieving radially outwardly

extending abutment part (422, 424) on the carrier sleeve (203) abutting an adjacent axial end of the magnets (204) to retain the magnets (204) in position on the carrier sleeve (203) without damaging the axial end of the magnet (204).

27. A motor according to claim 26, wherein both ends of the retention sleeve (205) are turned in over stress-relieving radially outwardly extending abutment parts (422, 424) on the carrier sleeve (203) abutting the axial ends of the magnets (204) to retain the magnets (204) in position on the carrier sleeve (203).

28. A motor according to claim 26 or 27, wherein the or each abutment part (422, 424) comprises a ring (422) engaging a shoulder (424) on the carrier sleeve (203).

29. A permanent magnet motor having an elongate rotor provided with elongate permanent magnet means (204) extending therealong, and a stator coaxial with the rotor, wherein the permanent magnet means (204) incorporates axially laminated parts to reduce eddy current losses.

30. A motor having a rotor and a stator coaxial with the rotor, wherein the rotor is mounted in a bearing, and one of the stator and the bearing is provided with resiliently biased projection means (3702) for engaging within receiving means (3701) provided on the other of the stator and the bearing to prevent relative rotation therebetween when the rotor begins to rotate with respect to the stator on starting of the motor.

31. A motor according to claim 30, wherein the projection means (3702) is provided on the outer of the stator and the bearing, and the receiving means (3701) is provided in the inner of the stator and the bearing.

32. A motor having a rotor and a stator coaxial with the rotor, wherein the stator is mounted in a housing (202), the stator being locked within the housing (202) by an axial key (3603) engaging within an axial groove (3601, 3602) in at least one of the stator and the housing (202) to prevent the stator from turning relative to the housing (202).